

WHAT IS CLAIMED IS:

1. A keyboard musical instrument comprising:
  - an acoustic keyboard musical instrument including
    - a case having a bottom board for defining a bottom of said case, said bottom board being formed with plural holes, and
    - a tone generating mechanism housed in said case and selectively generating tones; and
    - an automatic playing system actuating said tone generating mechanism for generating said tone without any fingering of a human player, and including
      - plural actuators having respective plungers passing through said plural holes and reciprocally moved for actuating said tone generating mechanism and respective converters for converting a certain sort of energy to a force exerted on said plural plungers and
      - a controller connected to said converters so as to selectively drive said plungers to actuate said tone generating mechanism.
2. The keyboard musical instrument as set forth in claim 1, in which each of said plural holes has a cross section wider than a cross section of associated one of said plungers so that said each of said plural holes is moved without friction on an inner surface defining said associated one of said plungers.
3. The keyboard musical instrument as set forth in claim 1, in which said each of said plural holes has a cross section wider than a cross section of as-

sociated one of said plungers and narrower than a cross section of associated one of said converters.

4. The keyboard musical instrument as set forth in claim 1, in which said converters are arranged in a staggered manner, and said plungers are projectable from and retractable into the associated converters so that said plural holes are arranged in said staggered manner.
5. The keyboard musical instrument as set forth in claim 4, in which said converters are alternately connected to an upper portion and a lower portion of a supporting frame.
6. The keyboard musical instrument as set forth in claim 1, in which each of said plungers has a shaft portion and a head portion made of resilient material and having a cross section wider than a cross section of said shaft portion, and said cross section of said head portion is narrower than a cross section of associated one of said plural holes so that said plunger passed through said associated one of said plural holes from an obverse surface of said bottom board in an assembling work.
7. The keyboard musical instrument as set forth in claim 1, in which said plural actuators further have stoppers respectively secured to said plungers, and each of said plural holes has a cross section wider than a cross section of associated one of said stoppers so that said associated one of said stoppers is movable in said each of said plural holes.
8. The keyboard musical instrument as set forth in claim 1, in which said plural actuators further have respective bushes formed with through-holes and

engaged with said bottom board for closing said plural holes, and said plungers pass through said through-holes of said bushes.

9. The keyboard musical instrument as set forth in claim 1, in which said tone generating mechanism includes

plural keys rotated by said human player or said plural actuators,  
plural action units respectively linked with said plural keys, respectively,  
and selectively actuated by said plural keys,  
strings vibratory for generating said tones and  
plural hammers respectively linked with said plural action units and  
driven for rotation by said plural action units for striking said strings.

10. The keyboard musical instrument as set forth in claim 9, in which said plural keys, said plural action units, said strings and said plural hammers are housed in said case forming a part of a grand piano.

11. The keyboard musical instrument as set forth in claim 9, in which said plural keys, said plural action units, said strings and said plural hammers are housed in said case forming a part of an upright piano.

12. The keyboard musical instrument as set forth in claim 1, in which said converters are used for converting electric power to a magnetic force, and said plunger projects from said converters in the presence of said magnetic force and is retracted into said converters in the absence of said magnetic force.

13. The keyboard musical instrument as set forth in claim 12, in which said converters are solenoids.

14. A method for retrofitting an acoustic keyboard musical instrument to an automatic player keyboard, comprising the steps of:

a) preparing a handy tool and an automatic playing system including a controller and plural actuators having respective plungers and respective converters to be connected to said controller for converting a certain sort of energy to a force to be exerted on said plungers;

b) determining portions of a bottom board forming a part of said acoustic keyboard musical instrument;

c) forming holes at said portions by using said handy tool; and

d) providing said converters in a space below said bottom board in such a manner that said plungers reach a space under a tone generating mechanism of said acoustic keyboard musical instrument through said holes.

15. The method as set forth in claim 14, in which said step b) includes the sub-steps of

b-1) putting marks indicative of boundaries between keys of said acoustic keyboard musical instrument on a surface of a member inserted between said keys and said bottom board,

b-2) calculating an intermediate point of each distance between the adjacent marks, and

b-3) determining each of said portions around said intermediate point.

16. The method as set forth in claim 14, in which said acoustic keyboard musical instrument is a grand piano so that said bottom board serves as a key bed of said grand piano.

17. The method as set forth in claim 14, in which said acoustic keyboard musical instrument is an upright piano so that said bottom board serves as a key bed of said upright piano.
18. The method as set forth in claim 17, in which said d) includes the sub-steps of
- d-1) moving said plural actuators under said bottom board,
  - d-2) aligning said plungers with said holes,
  - d-3) lifting said plural actuators toward said bottom board so that said plungers are exposed to a space over said bottom board through said holes, and
  - d-4) securing an actuator holder connected to said plural actuators to said case so that said actuators are provided in said space below said bottom board.
19. The method as set forth in claim 18, in which each of said holes has a cross section wider than the widest cross section of associated one of said plungers.